

**APPARATUS FOR PRODUCING SYNTHETIC RESIN FILM****SPECIFICATION****FIELD OF THE INVENTION**

My present invention relates to an apparatus for  
5 producing synthetic resin film by the film-blowing process and,  
more particularly, to a sizing or calibrating apparatus which  
determines at least the outer diameter of the blown thermoplastic  
tube.

**BACKGROUND OF THE INVENTION**

10 In the production of blown film, the film-making  
apparatus comprises an extruder for extruding a thermoplastified  
synthetic resin tube which is expanded by blowing and is passed  
through a calibrating basket which serves to define the expanded  
diameter of the blown tube and thus determines the thickness of  
15 the film.

The calibrating basket is provided with guide stirrups  
which guide the synthetic resin tube and have foil guide rollers  
whose outer peripheries contact the film of the tube.

In such a calibrating basket, around the periphery of  
20 the calibrating basket and thus over the periphery of the  
synthetic resin tube guided through it, there are distributed a  
multiplicity of such guide stirrups. These guide stirrups are  
distributed in the longitudinal direction of the calibrating

basket and, therefore, the direction of travel of the tube. The guide stirrups are provided with guide rods on which a multiplicity of film guide rollers can be provided next to on another, i.e. in neighboring relationship. The guide rods of a guide stirrup can be bent to match the shape of the synthetic resin tube.

In the past, the rollers have operated in accordance with the slide-bearing principle, i.e. were free from rolling surfaces and had relatively movable surfaces that slid on one another. These slide surfaces, could be made from a low friction material like polytetrafluoroethylene. In a special case, the guide rollers were hollow cylindrical bodies made from Teflon and were slipped onto the guide rods. Slide bearing rollers rotate around the guide rods or rest thereon generally in such manner that there are two points of contact between the slide bearing roller and the rod. A substantial amount of friction heat is generated with these rollers and sliding surfaces may even partially melt because of the friction heat which is generated. This melting of the guide rollers can result in fusion of them to the guide rods so that the guide rollers no longer are rotatable or can give rise to irregular rotation.

Immobilization of such a roller can result in the undesirable marking of the film with contact stripes. When some rollers rotate and others do not, the film may be pinched between adjacent rollers and that has a detrimental effect on film quality or increases the reject rate.

Conventional film guide rollers of the type described also have problems when the foil is somewhat tacky since then the friction between the foil rollers may be excessive and the rollers may develop rotational oscillation which can also result in film marking or detrimental calibration.

#### OBJECTS OF THE INVENTION

It is, therefore, the principal object of the present invention to provide a film-blowing apparatus and especially a blown tube calibrating apparatus whereby these drawbacks can be avoided.

Another object of the invention is to provide an improved apparatus for controlling the size of a blown extruded thermoplastic synthetic resin film tube which eliminates marking of the film and other problems with respect to the guidance of the film that have been encountered heretofore.

#### SUMMARY OF THE INVENTION

These objects and others which will be apparent hereinafter are attained in accordance with the invention in an apparatus for controlling the size of a blown extruded thermoplastic synthetic resin film tube which comprises a calibrating basket through which the blown extruded thermoplastic synthetic resin film tube passes and formed with guide stirrups, each having a multiplicity of tube-contacting film-guide rollers

disposed along each of the stirrups and supported on the respective stirrup with a respective roller bearing.

In accordance with the invention, therefore, the film guide rollers are roller bearing rollers and particularly ball bearing rollers.

The inner ring, according to the invention, may be fixed to the guide stirrup and can carry the outer ring through the array of roller elements, e.g. balls. The fact that the inner ring may be fixed means that the inner ring is not itself rotatable on the stirrup and generally is not shiftable thereon and can be itself fixed on the rod. The outer ring is rotatable on the inner ring by virtue of the array of balls therebetween. The inner ring and/or the outer ring may be made of a plastic, for example, a nylon. The roller elements themselves are preferably of a metal, for example steel. Roller bodies of glass may however also be used and the outer ring or the portion forming the roller may itself have an outer jacket, sheath or coating of an antiadhesion material such as polytetrafluoroethylene. The latter is especially suitable where the blown film tends to be somewhat tacky.

Between the rollers mounted on the stirrup, i.e. the rollers which are neighboring one another on the rod, a gap of preferably 0.5 mm to several mm in width may be provided.

The use of roller bearing rollers by comparison to slide bearing rollers of the prior art has been found to make the guiding of the blown film tube more reliable and free from

problems. The calibration is more precise, high friction is avoided, the heat generated is substantially reduced and the wear of the rollers is practically eliminated. Strip formation on the film is eliminated and jamming of the rotation of the rollers is no longer observed. Pinching of the foil between neighboring foil guide rollers is likewise eliminated.

The problem encountered with earlier basket-type calibrators are minimized or eliminated completely. Furthermore, baskets according to the invention can be readily applied to existing equipment in a simple and mechanical manner. Retrofitting of existing foil-blowing systems is no problem.

#### BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a front elevational view of a calibrating basket for use in the blowing of a thermoplastic synthetic resin film;

FIG. 2 shows a basket in place and is a section taken along line II-II of the basket of FIG. 1;

FIG. 3 is an illustration of a part of the basket in a prior art construction;

FIG. 4 is a cross section through a roller of the invention; and

FIG. 5 is an end view of this roller, partly broken away.

#### SPECIFIC DESCRIPTION

FIGS. 1 and 2 of the drawing show a calibrating part of an apparatus for blowing a plastic foil or film. The apparatus includes an extrusion and blowing head 20 from which a thermoplastified synthetic resin is extruded at 21 and blown at 22 to form the foil or film tube as it is advanced in the direction represented by the arrow 23. The extruded thermoplastified synthetic resin tube 22 passes through a calibration basket 1 which fixes the outer diameter of the tube and thus controls the wall thickness thereof and hence the thickness of the blown film. The film can be polyethylene, for example.

The calibration basket 1 is provided with a guide stirrup 2 which, as shown in FIGS. 1 and 2 can be mounted on a scissor link mechanism 24 between a pair of rings 25 and 26, the upper ring of which may be fixed, to allow the basket diameter to be increased or decreased (compare the dot-dash position shown in FIG. 1). In this sense, the calibration basket opens and closes like the diaphragm of a lens.

The stirrups 2 are equipped with bent guide rods 3 on which film guide rollers 4 are mounted. The foil guide rollers 4 engage the outer periphery of the film tube.

From FIGS. 1 and 2 it will also be apparent that a multiplicity of the guide stirrups 2 with guide rods 3 are distributed over the periphery of the calibrating basket 1. The radial arrows 27 in FIGS. 1 and 2 represent the contraction of  
5 th basket from its fully calibrated state as shown in solid lines.

From FIG. 3 it will be apparent that the guide rollers 4' of the prior art were slide bearing rollers in the form of hollow cylindrical bodies which were in sliding contact with the  
10 rod 3. These rollers engage the rod only at two contact points 5 with the disadvantages previously discussed.

FIGS. 4 and 5 show the rollers 4 of the present invention, i.e. the roller bearing rollers with their inner ring 6 which can be fixed on the rod 3 so that they are neither  
15 rotatable nor axially shiftable. The outer ring 7, however, is rotatable on the inner ring 6 via the array of bearing balls 8 which can be received in a cage 9. The ends of the bearing are closed by disks 10. The bearing balls are composed of metal, for example steel, or of glass and the rings 6 are composed  
20 pr ferably of a plastic like nylon. In a preferred embodiment a surface coating 11 on the outer ring 7 can be composed of an antiadhesion material like Teflon.

The rollers 4 may lie in contact with one another or have a small gap between them.